האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

THEORETICAL AND COMPUTATIONAL NEUROSCIENCE B - 76909

Last update 19-02-2014

HU Credits: 4

Degree/Cycle: 2nd degree (Master)

Responsible Department: Brain Science: Computation & Information Proc.

Academic year: 0

Semester: 1st Semester

Teaching Languages: English

Campus: E. Safra

Course/Module Coordinator: Haim Sompolinsky

Coordinator Email: haim@fiz.huji.ac.il

Coordinator Office Hours: By appointment

Teaching Staff:
Prof Yoram Burak
Mr. Haggai Agmon
Ms. Gal Vishne

Course/Module description:

Course/Module aims:

Learning outcomes - On successful completion of this module, students should be able to:

Attendance requirements(%):
0

Teaching arrangement and method of instruction: Lecture and Recitation sessions

Course/Module Content:
I. Introduction to Computational Neuroscience

II. Principles of sensory processing:
** Receptive fields and Efficient Coding*
** Information, Mutual Information, Entropy, and MaxEntropy*
** The Gaussian Ensemble*
** Infomax*
** Vision: Natural image statistics and Infomax predictions*
** Beyond Gaussianity*
** ICA*
** Compressed sensing and sparse coding*

III. Neural Population Codes
** Statistical characterization of neuronal population codes.*
** Fisher information theory and ML estimation/decision*
** Correlated population coding*
** Biological readouts*
** Spike based neural code*

** Bayesian computation in neural systems*

IV: Network dynamics and computation
** Rate based Models, Linear networks: Fixed Points and Stability, Symmetric networks, energy functions*
** Non-linear networks: Attractors, Lyapunov functions, symmetric networks*
** Spatial computation: spatial working memory, head direction, place cells and grid cells*
** Spatial computation: models*
** Asymmetric networks: linear networks and temporal working memory.*
** Dynamics and computation in chaotic neuronal networks*
** Balanced networks*

Required Reading:
none

Additional Reading Material:

Course/Module evaluation:
End of year written/oral examination 70 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 30 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information:
Home assignment grades will constitute at least 30% of the final course grade.